**香港考試及評核局**
**HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY**

**香港中學文憑考試**
**HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION**

**練習卷**
**PRACTICE PAPER**

**物理　試卷一**
**PHYSICS　PAPER 1**

# 評卷參考
# MARKING SCHEME

**（2012年2月25日修訂稿）**
**(updated as at 25 Feb 2012)**

本評卷參考乃香港考試及評核局專爲本科練習卷而編寫，供教師和學生參考之用。學生不應將評卷參考視爲標準答案，硬背死記，活剝生吞。這種學習態度，既無助學生改善學習，學懂應對及解難，亦有違考試着重理解能力與運用技巧之旨。

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Section A

| | |
|---|---|
| 1 | D |
| 2 | A |
| 3 | C |
| 4 | D |
| 5 | A |
| 6 | C |
| 7 | C |
| 8 | B |
| 9 | A |
| 10 | D |
| 11 | B |
| 12 | A |
| 13 | B |
| 14 | A |
| 15 | C |
| 16 | D |
| 17 | A |
| 18 | C |
| 19 | B |
| 20 | D |
| 21 | D |
| 22 | C |
| 23 | B |
| 24 | D |
| 25 | C |
| 26 | D |
| 27 | B |
| 28 | B |
| 29 | A |
| 30 | C |
| 31 | A |
| 32 | A |
| 33 | D |
| 34 | C |
| 35 | B |
| 36 | B |

## Section B Marking Scheme

### General Notes for Teachers on Marking

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2. The marking scheme may not exhaust all possible answers for each question. Teachers should exercise their professional discretion and judgment in accepting alternative answers that are not in the marking scheme but are correct and well reasoned.

3. In the marking scheme, marks are classified as follows :

   'M' marks – awarded for knowing a correct method of solution and attempting to apply it. (Candidates are not expected to write down the formula/method explicitly, marks could be awarded once candidates' work indicated that the particular formula/method had been used.)

   'A' marks – awarded for the accuracy of the answer. (For non-numerical answers, the answers need not be in exact wording as those in the marking scheme.)

   In a question consisting of several related parts, 'M' marks should be awarded to steps or methods correctly deduced from erroneous answers obtained in earlier parts. However, 'A' marks for the corresponding numerical answer should **NOT** be awarded.

4. In questions involving numerical computations, if a candidate's answer clearly indicated that a wrong method had been used (e.g. the application of a wrong formula), the 'A' marks should not be awarded even if the candidate had accidentally arrived at the correct numerical answer. In case of doubt, the benefit should be given in the candidate's favour.

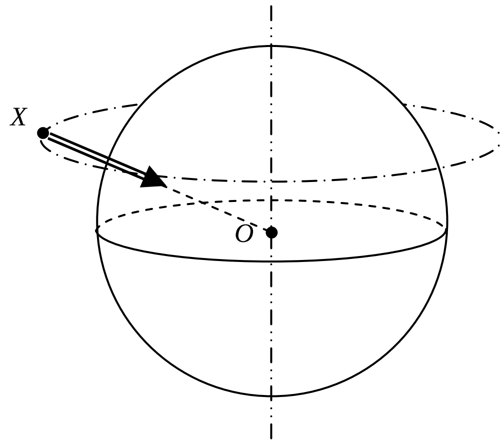
5. If the unit had been stated wrongly in the final numerical answer of a question, or if it had been omitted completely, no 'A' marks should be awarded to the final answer. However, candidates should not be penalised twice in the whole paper for the same error in that unit.

6. In questions asking for a specified number of reasons or examples etc. to be given and a candidate gave more than that is required, the surplus answers should not be marked. For example, in a question asking for two examples, if three had been given by a candidate, then only the first two answers should be marked.

7. Markers could exercise their judgment to split the '2A' or '2M' marks (if any), i.e. to award 1 mark only, if the answer is partially correct.

| Solution | Marks | |
|---|---|---|
| 1. (a) (i) A black surface is a good absorber of radiation. | 1A | |
| (ii) A cover reduces heat loss due to convection of air. | 1A | |
| (iii) The oil in the copper pipe inside the box is heated and rises. | 1A | |
| Cooler and denser oil from the pipe in the storage tank will move downward and replace the heated oil. | 1A | |
| OR: The oil in the copper pipe inside the box is heated and becomes less dense, | 1A | |
| they rise due to convection. | 1A | |
| | 4 | |
| (b) In 1 minute, $E = mc\Delta T$, | | |
| $= 0.3 \times 2500 \times (37 - 25)$ | 1M | |
| $= 9000$ J | | |
| $P = E / t$ | | |
| $= 9000 / 60$ | 1M | |
| $= 150$ W | 1A | |
| | 3 | |
| (c) The pressure increases with temperature. | 1A | |
| As temperature increases, the average kinetic energy / speed of the air particles increases. | 1A | |
| The air particles will hit the wall of the box more violently / more frequently. | 1A | |
| | 3 | |
| 2. (a) $a = 3/2 = 1.5$ m s$^{-2}$ | 1A | |
| By $T - mg = ma$ | 1M | |
| $T - 4 \times 9.81 = 4 \times 1.5$ | | |
| $T = 45.24$ N [46 N] | 1A | |
| | 3 | |
| (b) Power = $Fv$ | | |
| $= 4 \times 9.81 \times 3$ | 1M | |
| $= 117.72$ W [120 W] | 1A | |
| | 2 | |
| (c) The parcel first rises and comes to rest momentarily. | 1A | |
| It then falls freely under gravity. | 1A | |
| | 2 | |

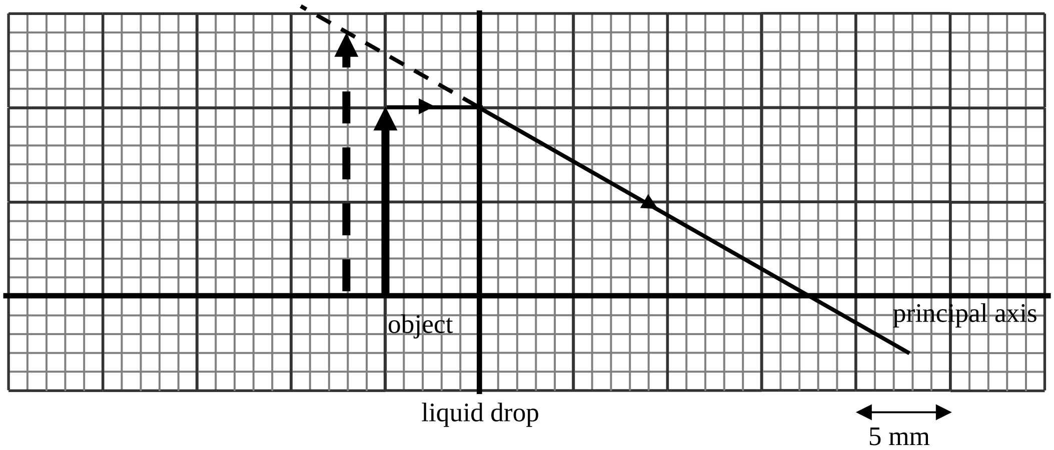
| Solution | Marks | |
|---|---|---|
| 3. (a) By the conservation of momentum,<br>$0.03\,v = 0.04 \times 3$<br>$v = 4\text{ m s}^{-1}$ | 1A | |
| | 1 | |
| (b) By P.E. lost = K.E. gain<br>$mgh = \frac{1}{2}mv^2$<br>$0.03 \times 9.81 \times h = 0.5 \times 0.03 \times 4^2$<br>$h = 0.815$ m [0.8 m] | 1M<br><br><br>1A | |
| | 2 | |
| (c) Time of flight = 1.2 / 3 = 0.4 s<br>Vertical distance ball $Y$ travelled before hitting the ground,<br>$S = \frac{1}{2}at^2$<br>$= 0.5 \times 9.81 \times 0.4^2$<br>$= 0.7848$ m [0.8 m]<br>The height $H$ of the bench is 0.7848 m [0.8 m]. | 1M<br><br><br>1M<br>1A | |
| | 3 | |
| (d) The time of flight remains unchanged<br>as the vertical displacement and the initial vertical speed remains unchanged.<br>OR :<br>as it is independent of the horizontal speed of the projectile. | 1A<br><br>1A<br><br>1A | |
| | 2 | |

| Solution | Marks | Remarks |
|---|---|---|
| 4. (a) (i) $\dfrac{GMm}{r^2} = m\omega^2 r$ | 1M | |
| $r^3 = \dfrac{GM}{\omega^2}$ | | |
| On earth's surface, $\dfrac{GMm}{r_E^2} = mg$ | 1M | |
| $GM = gr_E^2$ | | |
| Hence, $r^3 = \dfrac{GM}{\omega^2} = \dfrac{gr_E^2}{\omega^2} = \dfrac{gr_E^2 T^2}{4\pi^2}$ | | |
| $r = 4.24 \times 10^7$ m [$4.26 \times 10^7$ m] | 1A | |
| (ii) By $v = \dfrac{2\pi r}{T}$ | 1M | |
| $= \dfrac{2\pi(4.24\times10^7)}{86400}$ = 3080 m s$^{-1}$ [3100 m s$^{-1}$] | 1A | |
| | 5 | |
| (b) (i)   | 1A | |
| (ii) The direction of the required centripetal force is different from the direction of the gravitational force acting on the satellite. / The vertical component of the gravitational force will pull the satellite towards the equator.<br>The plane of orbit of a satellite must pass through the centre of the earth. / The gravitational force provides the centripetal force required. (Accept drawing the correct orbit in great circle.) | 1A | |
| | 2 | |

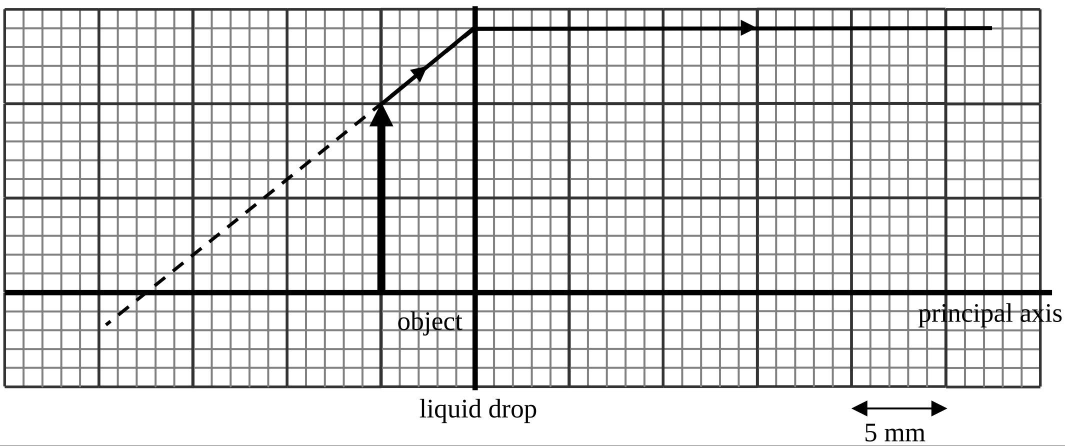
| Solution | Marks | |
|---|---|---|
| 5. (a) (i) Diffraction | 1A | |
| (ii) $v = f\lambda$ | 1M | |
| $= (25)(0.8)$ | | |
| $= 20 \text{ cm s}^{-1}$ | 1A | |
| (iii) The wavelength of the water wave decreases. | 1A | |
| The degree of diffraction decreases. | 1A | |
| | 5 | |
| (b) Path difference at $R = QR - PR$ | 1M | |
| $= 2.5\ \lambda$ | | |
| $\therefore$ Destructive interference at $R$. | 1A | |
| Amplitude of the water wave at $R$ decreases when another dipper is placed at $Q$. | 1A | |
| | 3 | |
| 6. Connect the ray box to the power supply and switch it on. | 1A | |
| Put the semi-circular glass block onto the protractor. | 1A | |
| Direct a light ray into the glass block through the curved side towards its centre. | 1A | |
| Vary the incident angle in the glass block until the refracted ray is parallel to the straight edge of the glass block. | 1A | |
| Make sure that the centre of the semi-circular glass block coincides with the centre of the paper protractor. Read the incident angle from the protractor and the critical angle of the glass block can be obtained. | 1A | |
| | 5 | |

| Solution | Marks | |
|---|---|---|
| 7. (a) Convex lens. | 1A | |
| A convex lens can produce magnified images. | 1A | |
| | 2 | |

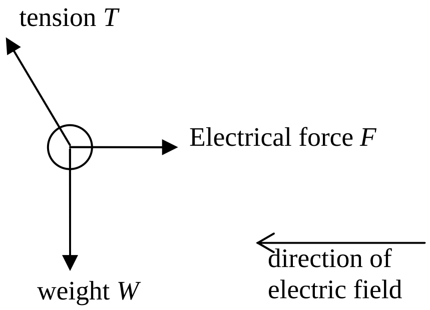
(b) (i)(ii)




OR: for (ii)




| | | |
|---|---|---|
| *Image position and height correct* | 1A | |
| *Construction ray correct* | 1M | |
| Focal length = 17.5 mm | 1A | |
| | 3 | |
| (c) The focal length of the liquid drop will increase. | 1A | |
| An incident ray parallel to the principal axis of the liquid will bend towards the principal axis less after passing through the liquid. | 1A | |
| | 2 | |

| Solution | Marks | |
|---|---|---|
| 8. (a)   | | |
| *any two forces correct* | 1A | |
| *all correct in the free body diagram* | 1A | |
| *direction of electric field correct* | 1A | |
| | 3 | |
| (b) (i) $\tan\theta = \dfrac{F}{W}$ | 1A | |
| (ii) Electric force $F = qE$<br>For parallel plates, $E = \dfrac{V}{d}$ | 1A | |
| From (i), $\tan\theta = \dfrac{F}{W} = \dfrac{qE}{mg} = \dfrac{qV}{mgd}$<br>$\therefore\ q = \dfrac{mgd\tan\theta}{V}$ | 1M | |
| $= \dfrac{(0.07\times10^{-3})(9.81)(0.1)\tan 2^\circ}{4000}$<br>$= 6.00 \times 10^{-10}$ C [$6.11 \times 10^{-10}$ C] | 1A | |
| | 4 | |
| (c) Move the polystyrene tile / the point of support of the nylon thread, | 1A | |
| so that the ball is placed in different positions in the space between the plates. | 1A | |
| Angle $\theta$ should remain the same if the electric field between the plates is uniform. | 1A | |
| | 3 | |

| Solution | Marks | |
|---|---|---|
| 9. (a) (i) $P = \frac{E}{t}$ | | |
| $= \frac{(2526-126)}{2\times 60}$ | 1M | |
| = 20 W | 1A | |
| (ii) $P = VI$ | | |
| $20 = 12 \times I$ | 1M | |
| $I$ = 1.67 A | 1A | |
| (iii) Total current = 1.67 × 2 | 1M | |
| = 3.34 A | | |
| The fuse will not blow as the total current is less than 5 A. | 1A | |
| | 6 | |
| (b) The r.m.s. voltage of the a.c. supply | | |
| $= \frac{15}{\sqrt{2}}$ =10.6 V | 1M | |
| which is smaller than 12 V, | | |
| hence the power output of the heater decreases. | 1A | |
| | 2 | |
| 10. (a) When the primary current is suddenly interrupted, | | |
| the magnetic field through the secondary coil changes, | 1A | |
| and an e.m.f. is induced across the secondary coil. | 1A | |
| | 2 | |
| (b) The number of turns of the secondary coil is much larger than that of the primary coil. | 1A | |
| The rate of change of magnetic flux is very large / the magnetic flux collapses in a very short time. | 1A | |
| | 2 | |
| (c) The resistance of thick wire is smaller, | 1A | |
| so that the primary current will be larger | 1A | |
| and the magnetic field produced will be stronger. | 1A | |
| OR: | | |
| By energy conservation, input power should be equal to the output power, | 1A | |
| To produce a large secondary voltage, the primary current should be large. | 1A | |
| Therefore thicker wire of smaller resistance should be used. | 1A | |
| | 3 | |

| Solution | Marks | Remarks |
|---|---|---|
| 11. (a) Put the GM tube close to a $^{238}$Pa sample, note the count rate. | 1A | |
| Insert a piece of paper between the sample and the GM tube / Put the GM tube more than 5 cm from the sample, | 1A | |
| the count rate will show no significant difference. | 1A | |
| This shows that no $\alpha$ radiation is emitted. | | |
| | 3 | |
| (b) $k = \dfrac{\ln 2}{t_{1/2}}$ <br> $k = \dfrac{\ln 2}{136}$ <br> $k = 5.10 \times 10^{-3}\ \mathrm{s}^{-1}$ | 1A | |
| | 1 | |
| (c) Corrected initial count rate = 1000 – 50 = 950 $\mathrm{min}^{-1}$ <br> Corrected final count rate = 250 – 50 = 200 $\mathrm{min}^{-1}$ | 1M | |
| By $C = C_o e^{-kt}$ <br> $200 = 950\ e^{-(\ln 2 / 136)\, t}$ | 1M | |
| $\left(\frac{\ln 2}{136}\right)t = \ln \frac{950}{200}$ <br> $t = 306$ s | 1A | |
| <u>OR :</u> By $C = C_o \left(\dfrac{1}{2}\right)^{\frac{t}{t_{1/2}}}$ | 1M | |
| $t = 306$ s | 1A | |
| | 3 | |

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## 練習卷
## PRACTICE PAPER

## 物理　　試卷二
## PHYSICS　PAPER 2

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|---|---|---|
| **Section A : Astronomy and Space Science**<br>1.1 D<br>1.2 D<br>1.3 C<br>1.4 B<br>1.5 A<br>1.6 C<br>1.7 A<br>1.8 C | | |
| 1. (a) (i) $\frac{\Delta\lambda}{\lambda}=\frac{v}{c}$<br>$v_A = \frac{(656.83-656.28)}{656.28} \times 3 \times 10^8 = 2.51 \times 10^5$ m s$^{-1}$ | 1A | |
| (ii) The H-alpha line of hydrogen gas at point *B* shows a blue shift, | 1A | |
| thus hydrogen gas at point *B* is moving towards the Earth. | 1A | |
| (iii) $\frac{mv_r^2}{r}=\frac{GMm}{r^2}$ | 1M | |
| $M=\frac{v_r^2 r}{G}=\frac{(2.51\times10^5)^2(10\times10^3\times3.08\times10^{16})}{6.67\times10^{-11}}$<br>$=2.92 \times 10^{41}$ kg | 1A | |
| | 5 | |
| (b) (i) By small angle approximation, $\frac{x}{d}=\theta$ | 1M | |
| Separation of *CE*, $x = d\theta$<br>$= 950 \times 1.6 \times \frac{\pi}{180}$<br>$= 26.5$ kpc | 1A | |
| (ii) The mass of *Y* may have an extended distribution/not concentrated at the center. | 1A | |
| | 3 | |
| (c) The radiation from a star can be approximated by a black body radiation curve. | 1A | |
| And the radiation spectrum of a black body is related to its temperature. | 1A | |
| | 2 | |

| Solution | Marks | Remarks |
|---|---|---|
| **Section B : Atomic World** | | |
| 2.1 A | | |
| 2.2 A | | |
| 2.3 C | | |
| 2.4 B | | |
| 2.5 B | | |
| 2.6 D | | |
| 2.7 B | | |
| 2.8 D | | |
| 2. (a) (i) According to wave theory, energy of light depends on the intensity / amplitude. | 1A | |
| No matter what the frequency is, photoelectrons should be emitted when the incident light is intense enough / when the time of exposure is long enough / when enough energy is stored after a certain time. | 1A | |
| (ii) According to the photoelectric equation, $\frac{1}{2} m_e v_{max}^2 = hf - \phi$ | | |
| Take K.E. = 0, | 1M | |
| $0 = hf_o - \phi$ | | |
| $\phi = h\frac{c}{\lambda_o}$ | | |
| $\phi = h\frac{c}{\lambda_o}$ | | |
| $= 6.63 \times 10^{-34} \times \frac{3\times10^{8}}{5.27\times10^{-7}}$ | 1M | |
| $= 3.77 \times 10^{-19}$ J | | |
| $\phi = \frac{3.77\times10^{-19}}{1.6\times10^{-19}} = 2.36$ eV | 1A | |
| (iii) It is the minimum energy required to release an electron from a metal surface against the attractive electric force of the metal. | 1A | |
| | 6 | |
| (b) (i) Number of photoelectrons = $\frac{I}{e} = \frac{1\times10^{-8}}{1.6\times10^{-19}}$ | 1M | |
| $= 6.25 \times 10^{10}$ | | |
| Number of photons = $6.25 \times 10^{10} \div 5\% = 1.25 \times 10^{12}$ | 1A | |
| (ii) With a more intense light source of the same type, more photons are emitted. | 1A | |
| Sufficient photons will be scattered by a smaller amount of smoke. | 1A | |
| Hence Peter's claim is correct. | | |
| | 4 | |

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| Solution | Marks | |
|---|---|---|
| **Section C : Energy and Use of Energy**<br>3.1 B<br>3.2 A<br>3.3 C<br>3.4 A<br>3.5 D<br>3.6 B<br>3.7 B<br>3.8 C | | |
| 3. (a) (i) The air in the double-glazed glass has a much lower thermal transmittance than glass / is a poor conductor / is a good insulator. | 1A | |
| The double glazed glass is thicker than the single layer window. | 1A | |
| (ii) (1) $\frac{Q}{t} = UA(T_{hot} - T_{cold})$<br>$= 2.8 \times 2 \times (36 - 24)$<br>$= 67.2$ W | 1A | |
| (2) As heat is also transferred through other means, e.g. radiation, | 1A | |
| the actual rate of heat transfer will be higher. | 1A | |
| (iii) Use solar control window film / drawing blinds<br>(accept other reasonable answers) | 1A | |
| | 6 | |
| (b) (i) The refrigerant evaporates | 1A | |
| and absorbs the latent heat of vaporization from the room. | 1A | |
| (ii) Heat removed from the room = $Pt$<br>$= 2.54 \times 10^3 \times 5 \times 60$ | 1M | |
| $= 7.62 \times 10^5$ J | 1A | |
| | 4 | |

| Solution | Marks | |
|---|---|---|
| **Section D : Medical Physics** | | |
| 4.1 B<br>4.2 C<br>4.3 A<br>4.4 D<br>4.5 C<br>4.6 D<br>4.7 D<br>4.8 A | | |
| 4 (a) The lung is filled with air / has a low density. | 1A | |
| | 1 | |
| (b) $I = I_0 e^{-\mu x}$<br>$\frac{I_0}{2} = I_0 e^{-\mu x_{1/2}}$<br>$\frac{1}{2} = e^{-\mu x_{1/2}}$<br>$e^{\mu x_{1/2}} = 2$<br>$\mu x_{1/2} = \ln 2$<br>$x_{1/2} = \frac{\ln 2}{\mu}$ | 1M<br><br>1M | |
| | 2 | |
| (c) By $I = I_o e^{-\mu x}$<br>$\frac{1}{8} = e^{-(0.20)x}$<br>$x = 10.4$ cm | 1M<br>1A | |
| <u>OR:</u> Intensity drops to 1/8 after passing through 3 half thicknesses.<br>Thickness of lung $= 3 \times \frac{\ln 2}{\mu} = 3 \times \frac{\ln 2}{0.20}$<br>$= 10.4$ cm | 1M<br><br>1A | |
| | 2 | |
| (d) Bone has a high linear attenuation coefficient.<br>Only very little X-ray can pass through to blacken the film.<br>The film appears white after being developed. | 1A<br>1A | |
| | 2 | |
| (e) An artificial contrast medium should be non toxic / can be excreted from the body / should not cause adverse reactions.<br>An artificial contrast medium should have a high linear attenuation coefficient | 1A<br>1A | |
| | 2 | |
| (f) The patient is exposed to less radiation in X-ray radiographic imaging.<br>X-ray radiographic imaging is fast / cheap / widely available. (any 1) | 1A | |
| | 1 | |